

In-situ semiconductor package chip alignment and warpage inspection technique using terahertz wave

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In this study, a terahertz time-domain spectroscopy (THz-TDS) system was used to inspect defects in the semiconductor packaging process, such as chip misalignment (rotation and tilting) and warpage. The defective package specimen was prepared by attaching silicon chips to the copper substrate in rotated and tilted positions, followed by the epoxy molding compound (EMC) molding process. The THz inspection technique was employed in reflection mode to assess the actual semiconductor packaging process. Chip misalignment due to rotation was measured using THz intensity reflected from the edge side of the chip. In addition, chip misalignment of tilting and warpage of the package were analyzed based on the detection time of THz signals from the surface of the chip's center and package. As a result, chip misalignment and warpage were inspected within 5 degrees, and 100 um error margins. The developed terahertz inspection method is expected to improve product yield through real-time, non-contact, and non-destructive testing of semiconductor packaging processes. Acknowledgements This work was supported by Korea Institute of Energy Technology Evaluation and Planning(KETEP) grant funded by the Korea government(MOTIE)(20212020800090, Development and Demonstration of Energy-Efficiency Enhanced Technology for Temperature-Controlled Transportation and Logistics Center). This work was also supported by the Agency For Defense Development by the Korean Government(UD230502DD). This research was also supported by a National Research Foundation of Korea (NRF) grant funded by the Korean Government (MEST) (2021M2E6A1084690). This work was supported by the National Research Foundation of Korea(NRF) grant funded by the Korea government(MSIT) (No. RS-2023-00260527).